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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/825,070	04/03/2001	Timothy G. Adams	50654	1972

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11/15/2002

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EXAMINER

LEE, SIN J

ART UNIT

PAPER NUMBER

1752

DATE MAILED: 11/15/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

mk-8

Office Action Summary

Application No.

09/825,070

Applicant(s)

ADAMS, TIMOTHY G.

Examiner

Sin J Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 August 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 17-27 and 31-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 17-27 and 31-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

1. Applicant canceled claims 1-16 and 28-30.

2. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: In claim 27, applicant recites "wherein the photoresist is heated . . . at a temperature of *not greater than about 120°C*." There is no antecedent basis for this temperature range for the post-exposure, pre-development thermal treatment (pg.6, lines 14-16 of present specification merely states that post-exposure, pre-development thermal treatment is frequently conducted about 110°C, 120°C or 125°C for no more than about 1 minute, and the temperature of 125°C is certainly higher than the claimed temperature range).

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 31 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. In claim 31, applicant recites "wherein the photoresist groups 1) comprise acetal groups or ester groups." There is no support for this claimed subject matter although there

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canceled
✓

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is support (see pg.3, lines 16-17 of present specification) for the resin with acetal and/or ketal moieties.

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 17-27 and 31-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al (6,022,665) in view of Jeoung et al (6,358,672 B2) (with Yamada (6,241,857 B1)

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which is being cited here to support the Examiner's position that it is known in the art that typically in a semiconductor device such as LSI, a contact hole is formed in an interlayer insulating film on a semiconductor substrate to connect a semiconductor element and wiring).

Watanabe teaches a chemically amplified positive resist composition suitable in ultra-LSI manufacture comprising a copolymer of their formula (2) which is shown in col.5, lines 45-21 and a photoacid generator (see col.2, lines 6-28, col.5, lines 45-67, col.6, lines 1-21). In the copolymer of their formula (2), Watanabe teaches that R^3 in the third repeating unit of the polymer is an acid labile group. Watanabe furthermore teaches (col.6, lines 46-67, col.7, lines 1-14) that the preferred acid labile groups are groups of their formulae (16) and (17) which are shown in col.6, lines 55-62. Since there are only two formulas to choose from, one of ordinary skill in the art would immediately envisage the formula (16) as the acid labile group, R^3 . Also, Watanabe teaches cyclohexyloxyethyl as one of dozen examples for the acid labile group of formula (16). Since there are only dozen examples to choose from, it is the Examiner's position that one of ordinary skill in the art would immediately envisage the cyclohexyloxyethyl group (which is a secondary acetal group, *presently claimed group reactive to crosslinking as well as present cycloalkyl units*) as the acid labile group, R^3 . In the last repeating unit of the copolymer of formula (2), Watanabe teaches that R^5 is a group $-\text{COOX}$ (wherein X is a hydrogen atom or acid labile group) or $-\text{C}_6\text{H}_4-\text{R}^6$. Since there are only two choices given, one of ordinary skill in the art would immediately envisage R^5 to be $-\text{COOX}$ wherein X is an acid labile group.

Therefore, the last repeating unit of the copolymer of formula (2) teaches *present alkyl acrylate*

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photoacid-labile group. The second repeating unit of the copolymer of formula (2) teaches *present phenolic group*. After the resist composition is coated onto a silicon wafer (present microelectronic wafer substrate), its is prebaked, exposed to deep-UV radiation of 254 to 193 nm (Watanabe also mentions a KrF excimer laser which has a wavelength of 248 nm), baked at 70-120°C for 30 -200 seconds (post exposure baking), and then developed with an aqueous base solution (see col.21, lines 23-34). Therefore, the prior art teaches the inventions of present claims 17-20, 27, and 31-38 except for the present step of thermally treating the developed photoresist layer to induce crosslinking of the photoresist components as claimed in claims 17 and 31.

Jeoung et al teach (col.4, lines 20-24) a method of forming a semiconductor device pattern through the formation of a uniform and a desired size of a contact hole pattern by applying a flow method for a deep UV photoresist. According to Jeoung's invention (col.6, lines 41-50), a developed photoresist pattern on a semiconductor wafer is irradiated with UV light after the developing process in order to make less critical dimension so that the distortion of the photoresist pattern during a flow process is prevented, and a desired pattern size can be effectively achieved. Jeoung's UV bake unit (see col.7, lines 24-29) includes a UV lamp for providing a UV light, and a hot plate for mounting a wafer with a distance from the UV lamp and *heating* the wafer. When the wafer is transferred into the UV bake unit after the developing process, UV light irradiation on the photoresist pattern and the bake process on the hot plate are carried out (see col.8, lines 16-23) so as to cause the *crosslinking reaction* inside the photoresist

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and the *flow process* simultaneously, and thereby achieve the smaller size of photoresist pattern than pattern after the development. Based on Jeoung's teaching, it would have been obvious to one of ordinary skill in the art to apply Jeoung's teaching to Watanabe's invention and carry out a UV baking step after developing Watanabe's pattern so as to induce crosslinking reaction inside Watanabe's photoresist and the flow process simultaneously in order to effectively achieve a desired pattern size as taught by Jeoung. Therefore, Watanabe in view of Jeoung would render obvious present inventions of claims 17-21, 27, and 31-38.

With respect to present claims 24-26, Jeoung et al do not explicitly teach the UV bake temperature for a deep UV photoresist. However, since Jeoung's UV baking step is being carried out so as to induce the crosslinking reaction inside the photoresist, it is the Examiner's position that the present temperatures of claims 24-26 would have been obvious to one of ordinary skill in the art, who will be carrying out the UV baking step for Watanabe's deep UV photoresist, because it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Therefore, Watanabe in view of Jeoung would render obvious present inventions of claims 24-26.

With respect to present claims 22 and 23, although Watanabe does not explicitly mention the presently claimed contact holes, it is known in the art (as evidenced by Yamada, col.1, lines 18-22) that typically in a semiconductor device such as LSI (Watanabe's photoresist material is used in the manufacture of ultra-LSI's), a through-hole (or contact hole) is formed in an

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interlayer insulating film on a semiconductor substrate to connect a semiconductor element and wiring. Therefore, it is the Examiner's position that one of ordinary skill in the art who reads Watanabe would understand that Watanabe's silicon wafer substrate comprises one or more contact holes and that when one carries out Jeoung's UV baking step in Watanabe's invention, Watanabe's photoresist layer would flow into the one or more contact holes during the baking step. Therefore, Watanabe in view of Jeoung would render obvious present inventions of claims 22 and 23.

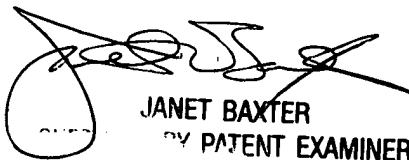
8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is (703) 305-0504. The examiner can normally be reached on Monday-Friday from 8:30 am EST to 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ms. Janet Baxter, can be reached on (703) 308-2303. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9311 for after final responses or (703) 872-9310 for before final responses.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0661.

S. J. Lee

S. Lee
November 11, 2002


JANET BAXTER
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EXAMINER 1700